LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Nov. 12-16, 2012

CNN Money — A Service of CNN, Fortune & Money — FAST FIVE

After years of trailing the Chinese and Japanese, the United States now has three of the four fastest supercomputers in the world.

And though Lawrence Livermore's Sequoia fell a spot on the list to Oak Ridge National Laboratory's Titan, Sequoia now takes on the No. 2 spot on the Top 500 list of the fastest supercomputers.

Titan clocks in at 17.6 petaflops (quadrillions of calculations per second) and it was a close race for the top position. Sequoia boasts a speed of 16.32 petaflops and topped the June edition the Top 500 list.

To read more about the fastest supercomputers, go to CNN.

smartplanet — THE HEART OF THE MATTER
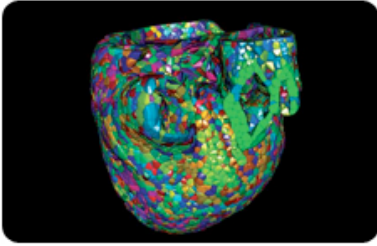
The Cardioid code, developed by a team of Livermore and IBM scientists, divides the heart into a large number of manageable pieces, or subdomains.

Researchers at the Laboratory are using the Sequoia supercomputer and a code called Cardioid to model the beating of the human heart in real time.

Researchers can now run detailed models of the heart quickly enough to examine how potentially fatal arrhythmias develop. They can determine the influence of individual genetic variations. They can see drug administration occur, and they can view how medical devices impact the organ.

Until recently, scientists didn't have the computing power needed to simulate the billions of muscle cells in a human heart. But Sequoia -- an IBM Blue Gene/Q supercomputer rated at more than 16 petaflops of performance -- has the muscle to make it happen. In concert with the Cardioid code, which is a high-resolution model of the organ, researchers can simulate thousands of heartbeats -- not just a dozen or so, as previously possible.

To read more, go to smartplanet.

LIVE SCIENCE. **THE SAFE AND THE FEARLESS**
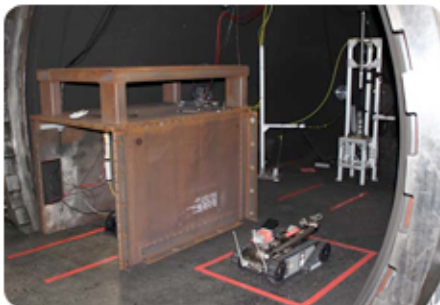
The LEXI robot assists humans in testing terrorist bomb-making recipes.

A fearless new robot named "LEXI" can help the U.S. Department of Homeland Security cook up potentially unstable explosive mixtures for the sake of studying terrorist tactics.

LEXI works inside the "firing tanks" used for testing the power of homemade explosives at the High Explosives Applications Facility at Lawrence Livermore. The robot's job is to take explosive cocktails from a vibrating mixer and place them on a firing table to prepare for detonation -- a task too dangerous for humans to handle.

"We need to see what a terrorist might use and how effective certain types of explosives might be in bringing down planes and other targets of interest," said Lee Glascoe, an engineer at the Laboratory.

To read more, go to [Live Science](#)

The Sequoia supercomputer

Sequoia, a world-class IBM BlueGene/Q computer sited at Lawrence Livermore for the National Nuclear Security Administration (NNSA), is exploring a broad range of science to shake out the machine and fully develop the capabilities the system will require to fulfill its national security missions, starting early 2013.

Researchers from the nation's three nuclear weapons laboratories are testing Sequoia's power and versatility by running unclassified science codes relevant to NNSA missions. Science being explored by Lawrence Livermore researchers includes high energy density plasmas and the electronic structure of heavy metals.

The early science runs are part of the "shakeout" of the 20-petaflop peak IBM BlueGene/Q system, which will transition in March 2013 to classified work for NNSA's Advanced Simulation and Computing (ASC) Program, a cornerstone of the effort to ensure the safety, security and effectiveness of the nation's nuclear deterrent without underground testing (stockpile stewardship). Sequoia's mammoth computational power will be used to assess physical weapons systems and provide a more accurate atomic-level understanding of the behavior of materials in the extreme conditions present in a nuclear

weapon.

To read more, see .

A CLEAN, LIMITLESS BURN

Inside NIF

Power plants based around nuclear fusion are clean, economical to operate and can provide virtually limitless amounts of power.

They are also still non-existent, but that may change in a few years, according to Ed Moses, principal associate director of the Laboratory's National Ignition Facility (NIF) speaking at the recent Big Science conference sponsored by The Atlantic.

The Lab is close to demonstrating a controlled, sustained fusion reaction with an array of high-powered lasers. The lasers essentially squish a peppercorn-sized target filled with hydrogen into something about the diameter of a human hair. The pressure and heat on the target transform hydrogen into helium, generating unfathomable amounts of heat in the process. The NIF has achieved "burn," i.e. fusion, but not yet succeeded in transforming that into a chain reaction.

"We have started the spark but haven't held it together long enough to propagate out," Moses said metaphorically. "It is not a technical issue. We don't need a bigger laser."

To read more, go to .

LIVERMORE LAB REPORT

Livermore Lab Report takes a break

The _Livermore Lab Report_ is taking a break for the week of the Thanksgiving holiday. It will return on Nov. 30.